AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1. (currently amended) An image coding method comprising:

~~a step of~~ deciding the type of an image in tile units and deciding the type of each tile according to the ~~decision~~ image type deciding result;

~~a step of~~ grouping all pixels included in a predetermined type of tile into pixels belonging to a first layer and pixels belonging to a second layer pixel by pixel; and

~~a step of~~ performing different kinds of signal processing on the pixels belonging to said first layer and the pixels belonging to said second layer and then coding the processed signals.

Claim 2. (currently amended) An image coding method comprising:

~~a step of~~ deciding whether each tile of an input image is a character image or a photographic image and grouping each tile into a character tile or photographic tile according to the ~~decision~~ deciding result;

~~a layering processing step of~~ grouping all pixels that belong to ~~said~~ the character tile into pixels belonging to a foreground and pixels belonging to a background pixel by pixel;

~~a step of~~ deciding which of first signal processing suitable for compression of photographic images or second signal processing suitable for compression of bi-level images should be applied to each of ~~all~~ the pixels belonging to ~~said~~ the character tile pixel by pixel with reference to the result of ~~said layering processing~~ grouping all pixels and performing either ~~said~~ the first or second signal processing on brightness information of each pixel according to ~~said~~ the decision; and

~~a step of~~ performing variable-length coding on information resulting from ~~said~~ the first or second signal processing.

Claim 3. (currently amended) The image coding method according to claim 2, wherein ~~said~~ the first signal processing ~~is~~ comprises orthogonal transformation and quantization processing , and ~~said~~ the second signal processing ~~is~~ comprises approximation processing that approximates brightness values of a plurality of pixels with a single typical value and ~~said~~ the variable-length coding ~~is~~ comprises arithmetic coding.

Claim 4. (currently amended) An image coding method comprising:

~~a step of~~ deciding whether each tile of an input image is a character image or a photographic image and grouping each tile as a character tile or a photographic tile according to the deciding result;

~~a step of~~ grouping all pixels included in ~~said~~ the character tile into pixels belonging to a foreground and pixels belonging to a background pixel by pixel and

acquiring bitmap information indicating whether each pixel belongs to the foreground or background;

~~a step of~~ deciding whether or not it is possible ~~or not~~ to apply approximation processing which approximates brightness values of all pixels belonging to ~~said~~ the foreground of ~~said~~ the character tile or brightness values of all pixels belonging to ~~said~~ the background with one typical value;

~~a step of~~ deciding whether or not it is possible ~~or not~~ to apply approximation processing which approximates brightness values of all pixels included in ~~said~~ the photographic tile with one typical value;

~~a step of~~ applying orthogonal transformation and quantization processing to brightness information of all pixels of ~~said~~ the photographic tile to which approximation processing is not applicable and to brightness information of all pixels in ~~said~~ the character tile to which approximation processing is not applicable; and

~~a step of~~ applying variable-length coding to information indicating whether ~~said~~ the approximation processing is applicable or not, to information of ~~the~~ an approximate value indicating the result of ~~said~~ the approximation processing, to information on the brightness resulting from ~~said~~ the orthogonal transformation and quantization processing and ~~said~~ the bitmap information.

Claim 5. (currently amended) The image coding method according to claim 4, further comprising ~~a coding rate controlling step of~~ predicting a coding rate

when ~~said~~ the variable-length coding is applied to the next tile and adaptively changing the quantization step width in ~~said~~ the quantization processing based on the predicted value so that the coding rate falls within a predetermined range.

Claim 6. (currently amended) The image coding method according to claim 4, further comprising ~~a coding rate controlling step of~~ predicting a coding rate ~~first~~ when the next tile is subjected to ~~said~~ the variable-length coding, generating a scaling factor (α) with an integer value to adaptively change the quantization step width in ~~said~~ the quantization processing based on the predicted value so that the coding rate falls within a predetermined range, ~~then~~ generating a scaling factor (β) with a real number value having a one-to-one correspondence with ~~this~~ the scaling factor (α) ~~with an integer value~~ and changing the quantization step width in ~~said~~ the quantization processing using ~~this~~ the scaling factor (β) ~~with a real number value~~.

Claim 7. (currently amended) The image coding method according to claim 6, wherein a correlation between a coding rate, ~~said~~ the integer value scaling factor (α) and ~~said~~ the real number value scaling factor (β) is determined so that a differentiation value of a function (f1) to generate ~~said~~ the real number value scaling factor (β) from ~~said~~ the integer value scaling factor (α) becomes the inverse ~~number~~ of a function (f2) indicating a relationship of ~~said~~ the real number value scaling factor (β) with ~~said~~ the coding rate.

Claim 8. (currently amended) An image coding apparatus comprising:

an image area ~~deciding section~~ decider that groups an input image into character image tiles and photographic image tiles;

a layering section that ~~performs layering that~~ groups each pixel into ~~any~~ one of a plurality of predetermined layers based on the brightness level of each pixel included in at least one tile among character image tiles or photographic image tiles and generates bitmap information indicating the layer in which each pixel is included;

an approximation ~~processing section~~ processor that decides, based on brightness information of said input image, whether or not it is possible ~~or not~~ to approximate a plurality of image brightness values with one typical value in tile units or using said layer as a unit and performs approximation processing when approximation is ~~applicable~~ possible;

an orthogonal transformation/quantization section that performs orthogonal transformation and quantization on brightness information ~~to~~ for which bi-level approximation is not ~~applicable~~ possible; and

a ~~coding section~~ coder that applies variable-length coding to data of the approximate value resulting from the approximation processing, data resulting from said orthogonal transformation and quantization, said bitmap information indicating the layer to which each pixel in said tile belongs and information indicating whether or not approximation processing is ~~applicable or not~~ possible.

Claim 9. (currently amended) The image coding apparatus according to claim 8, further comprising a coding rate ~~control section~~ controller that predicts a coding rate based on the amount of image already coded and adaptively ~~deciding~~ decides the quantization step width used in the quantization processing by said orthogonal transformation/quantization section based on the predicted value so that the coding rate falls within a predetermined range.

Claim 10. (currently amended) The image coding apparatus according to claim 9, wherein said coding rate ~~control section~~ controller predicts a coding rate, ~~first~~ generates an integer value scaling factor (α) to adaptively change said quantization step width in said quantization processing based on the predicted value so that the coding rate falls within a predetermined range, ~~then~~ generates a scaling factor (β) with a real number value having a one-to-one correspondence with ~~this~~ the integer value scaling factor (α) and ~~gives~~ inputs ~~this~~ the real number value scaling factor (β) to said orthogonal transformation/quantization section.

Claim 11. (currently amended) The image coding apparatus according to claim 10, wherein a correlation between a coding rate, ~~said~~ the integer value scaling factor (α) and ~~said~~ the real number value scaling factor (β) is predetermined so that a differentiation value of a function (f1) to generate ~~said~~ the real number value scaling factor (β) from ~~said~~ the integer value scaling factor (α

) ~~becomes~~ is the inverse ~~number~~ of a function (f2) indicating a relationship of said real number value scaling factor (β) with said coding rate.

Claim 12. (currently amended) A coding rate control apparatus comprising:

a coding rate ~~estimation section~~ estimator that divides a multi-valued image into tiles of a predetermined size and estimates the coding rate of the tile based on the amount of image already coded when coding is performed after signal processing including quantization processing;

a first scaling factor generator that generates an integer value scaling factor (α) to adaptively change the quantization step width in said quantization processing according to the coding rate estimation result; and

a second scaling factor generator that generates a scaling factor (β) with a real number value having a one-to-one correspondence with ~~said~~ the integer value scaling factor (α) and supplies the real number value scaling factor (β) to a quantizer that performs said quantization processing.

Claim 13. (currently amended) The coding rate control apparatus according to claim 12, wherein a correlation between a coding rate, ~~said~~ the integer value scaling factor (α) and ~~said~~ the real number value scaling factor (β) is predetermined so that a differentiation value of a function (f1) to generate ~~said~~ the real number value scaling factor (β) from ~~said~~ the integer value scaling factor (α

) becomes the inverse ~~number~~ of a function (f2) indicating a relationship of ~~said~~ the real number value scaling factor (β) with said coding rate.